

Development of Chemical, Physical, & Toxicity Criteria for DoD Acquisition Programs



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What's the Challenge?

Acquisition, Technology and Logistics



- Increased performance & reliability of new weapon systems require new materials and chemicals.
- DoD lacks detailed guidance to determine what data are needed & when to assess & manage life-cycle risks

DoD Acquisition Policies

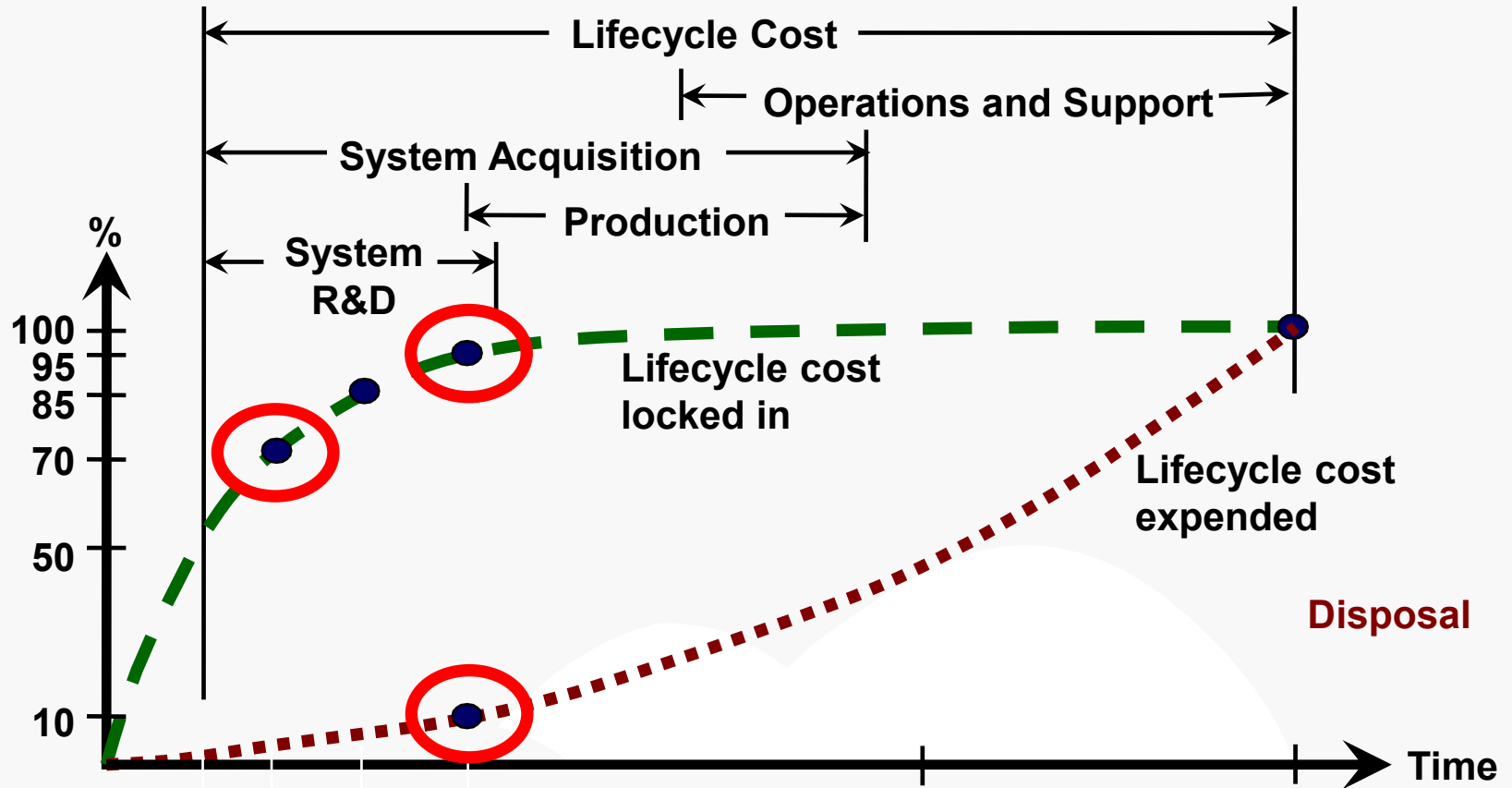
- **DoDD 5000.1 – The Defense Acquisition System (May 12, 2003)**
 - “Safety shall be addressed throughout the acquisition process. Safety considerations include human (includes human/system interfaces), toxic/hazardous materials and substances, ...”

- **DoDI 5000.2 – Operation of the Defense Acquisition System (May 12, 2003)**
 - Programmatic Environmental and Occupational Health Evaluation (PESHE) is required.....
 - As part of risk reduction, the PM shall prevent ESOH hazards where possible, and manage ESOH hazards where they cannot be avoided. ...
 - During system design, the PM shall document hazardous materials used in the system and plan for the system’s demilitarization and disposal.

But...what *specifically* do we need to know to assess & manage risks...
and when do we need to know it?

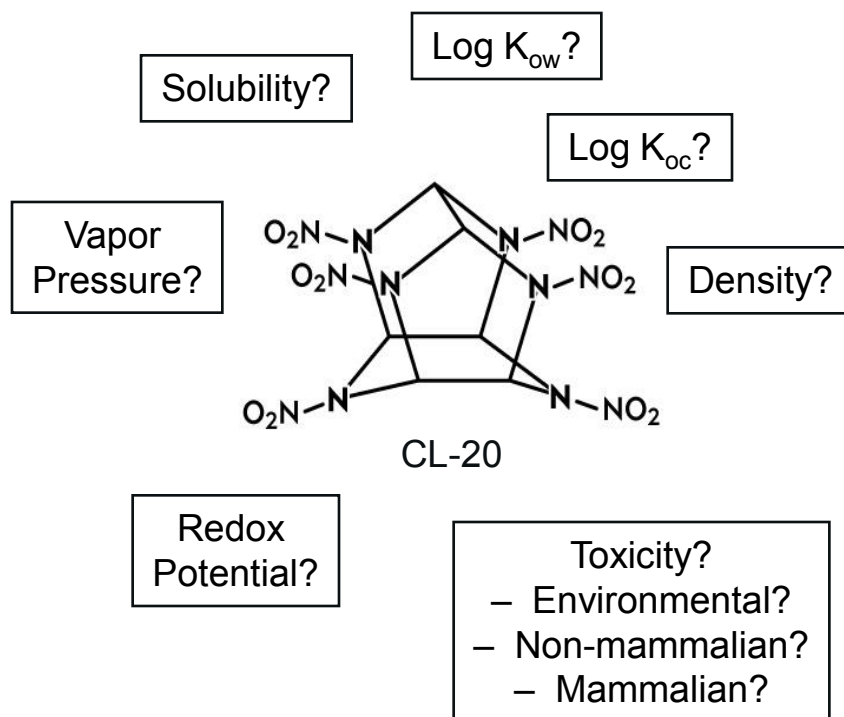
Percent Cost Locked-In By Design Phase

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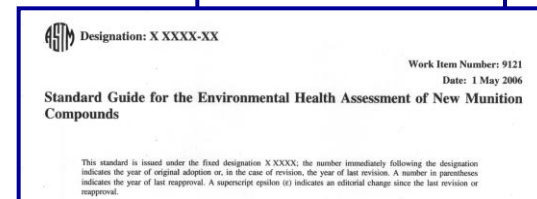
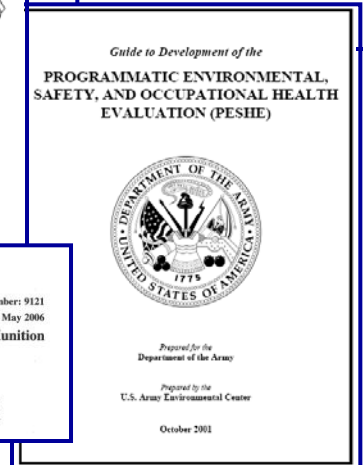
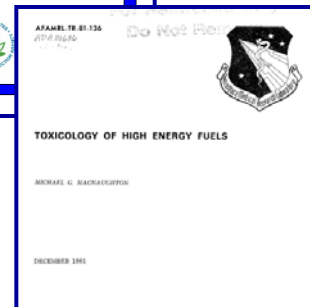
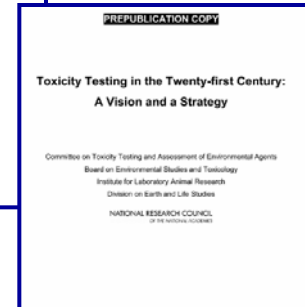
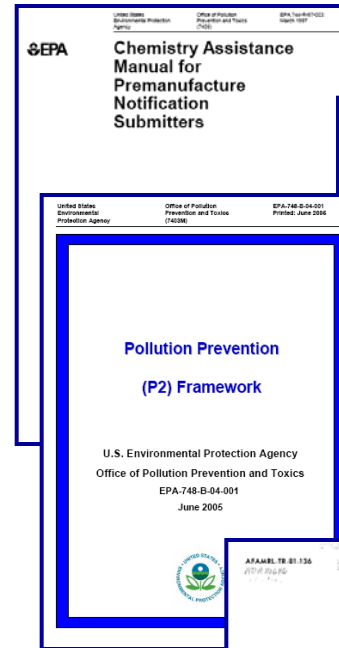
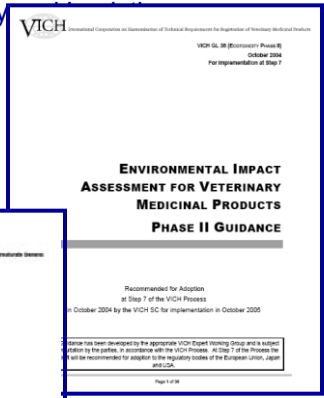
What's the Solution?

- **Benchmark existing guidance, policy, and practices.**
- **Develop standard set of physical, chemical, and toxicological data needs – select needs for specific programs.**
- **Identify critical points in the DoD acquisition process requiring specific data.**
- **Develop guidance for DoD acquisition community**



Benchmarking Results

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- Examined public & private practices world-wide, including DoD
- Each had limitations
 - limited to one group or category of chemicals
 - not designed to evaluate life-cycle risks
 - don't easily fit military acquisition process
- Selected best features from each

Standard Set of Data Needs

- Detailed data needs for chemicals/materials with consistent display format
- Data needs vary based on application and predicted exposures
 - 92 possible elements
- Data used to better identify, assess, & mitigate risks

Mammalian Toxicity/Carcinogenicity						
Environmental and Non-Mammalian Toxicity						
Environmental Fate and Transport Characteristics						
Physical-Chemical Information						
General Chemical, Production, and Use Information						
Item #	Evaluation Item	Utility/ Information Provided	Chemical Lifecycle Stage when Data Desirable	Caveats	More Information	Notes
1.01	Chemical name	- identity - communication	Conception		OECD, 2007b	A
1.02	Molecular formula & weight, computational	- chemical identification - exposure characterization	Conception	polymers frequently reported as number-average weight	ASTM, 2008 ^a Johnson et al., 2007 ^a USEPA, 1997 ^b OECD, 2007b ^a	
1.03						

Proposed Data Needs

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- **Elements (13) of the general chemical, production and use information**
 - Chemical identification information
 - Molecular and physical state information
 - Production volume
 - Production methods
 - Uses
 - Disposal methods
- **Elements (19) of physical-chemical information**
 - Melting and boiling point
 - Vapor pressure
 - Oxidation-reduction potential
 - Explosive properties

Proposed Data Needs

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- **Elements (30) of environmental fate and transport characteristics**
 - Solubility
 - Partitioning among environmental media
 - Degradation/stability
 - Breakdown product identification
- **Elements (28) of environmental and non-mammalian toxicity**
 - Toxicity to aquatic organisms
 - Toxicity to terrestrial organisms
 - Biotransformation and kinetics in species for which long-term tests are conducted

Proposed Data Needs

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- **Elements (29) mammalian toxicity/carcinogenicity**

- Toxicity to mammalian test species
- Toxicokinetics, metabolism and distribution in test species
- Mode of action for toxic effects
- Extrapolation of dose-response curve to humans

Proposed DoD New Chemical Human and Environmental Health Evaluation Process

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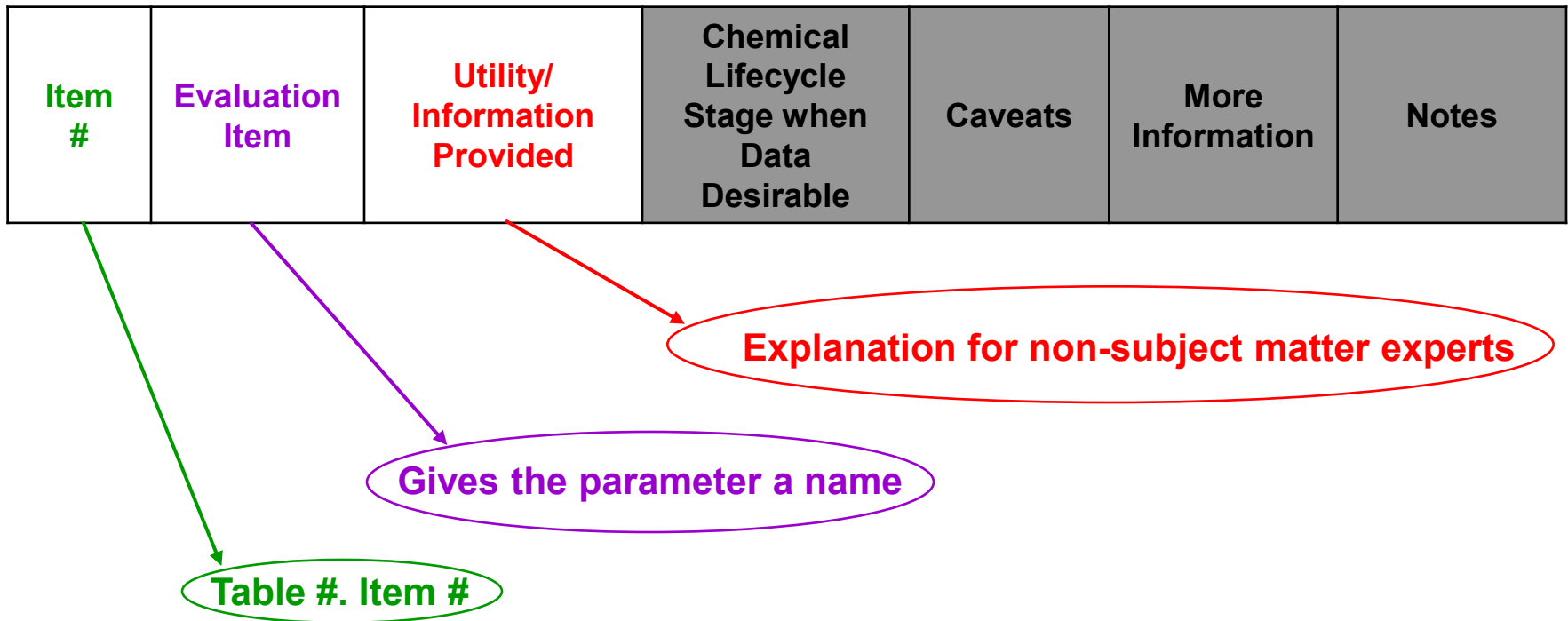
Organization of the Information Tables

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Proposed DoD New Chemical Human and Environmental Health Evaluation Process

Acquisition, Technology and Logistics

Organization of the Information Tables (cont.)



Proposed DoD New Chemical Human and Environmental Health Evaluation Process

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Organization of the Information Tables (cont.)

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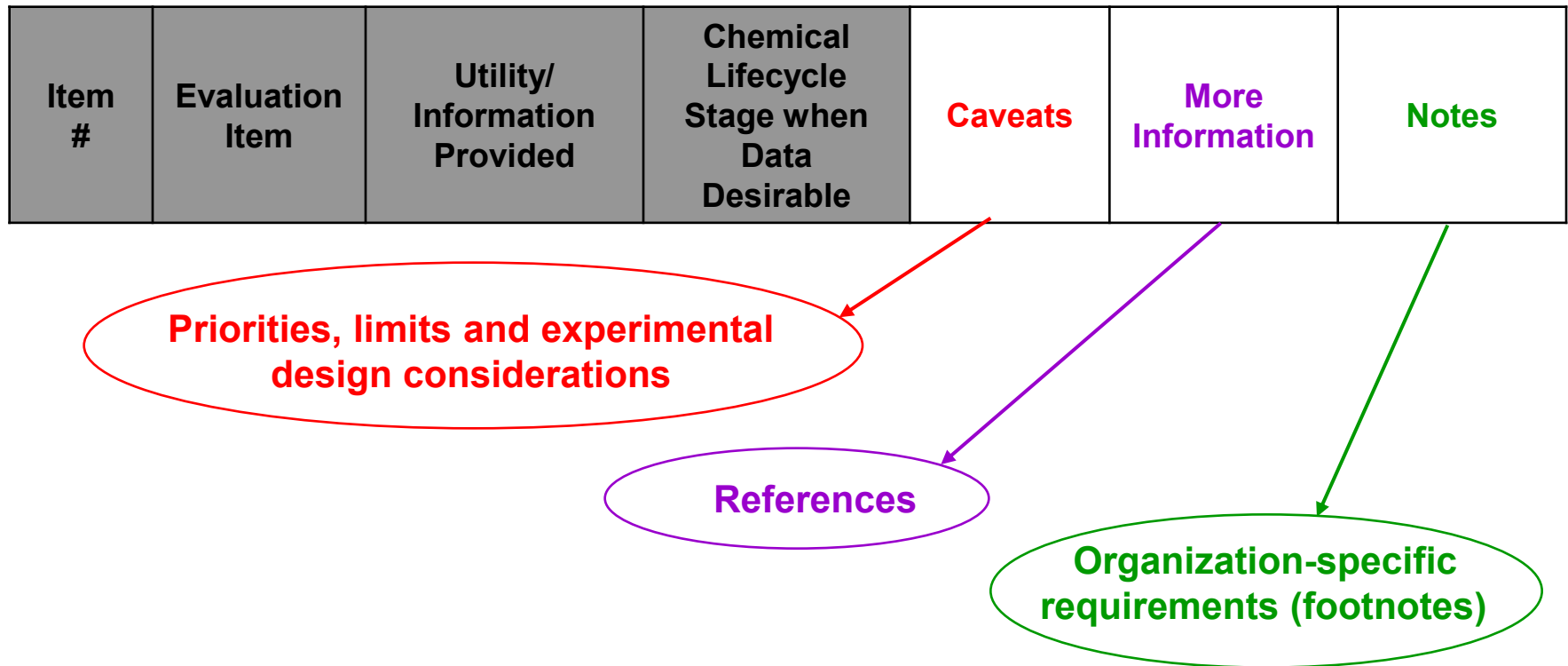


- **Conception:** Molecular relationships and characteristics are evaluated to gain an understanding of the chemicals properties
- **Synthesis:** Production of chemical or material is demonstrated and perhaps optimized
- **Testing:** Chemical or material tried in the specific application or system configuration for which it was developed
- **Production:** Specific formulations established and mass production is planned

Proposed DoD New Chemical Human and Environmental Health Evaluation Process

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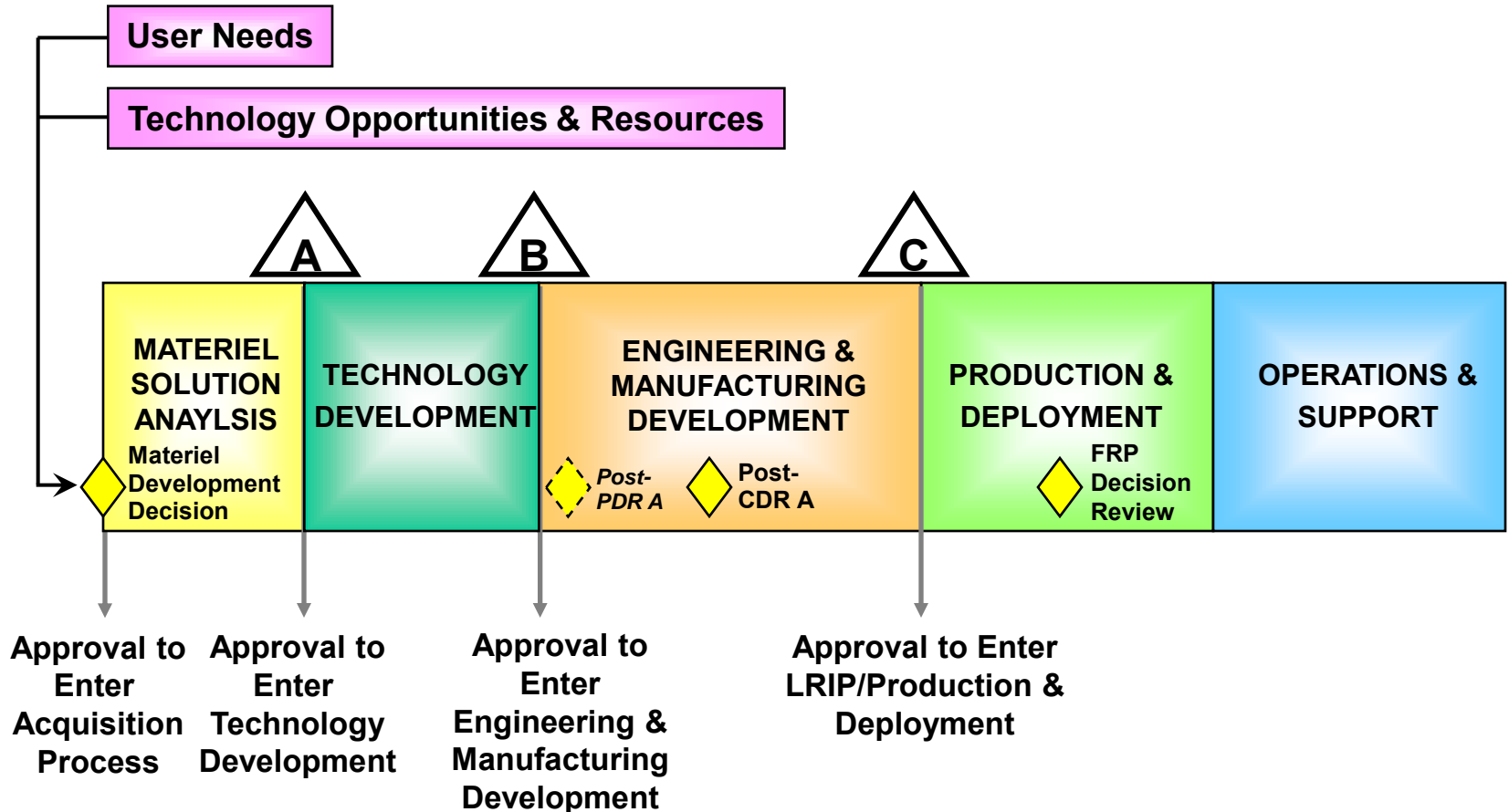
Organization of the Information Tables (conc.)



**How do we incorporate this into the
DoD acquisition process??**

Match to DoD Acquisition Decision Points

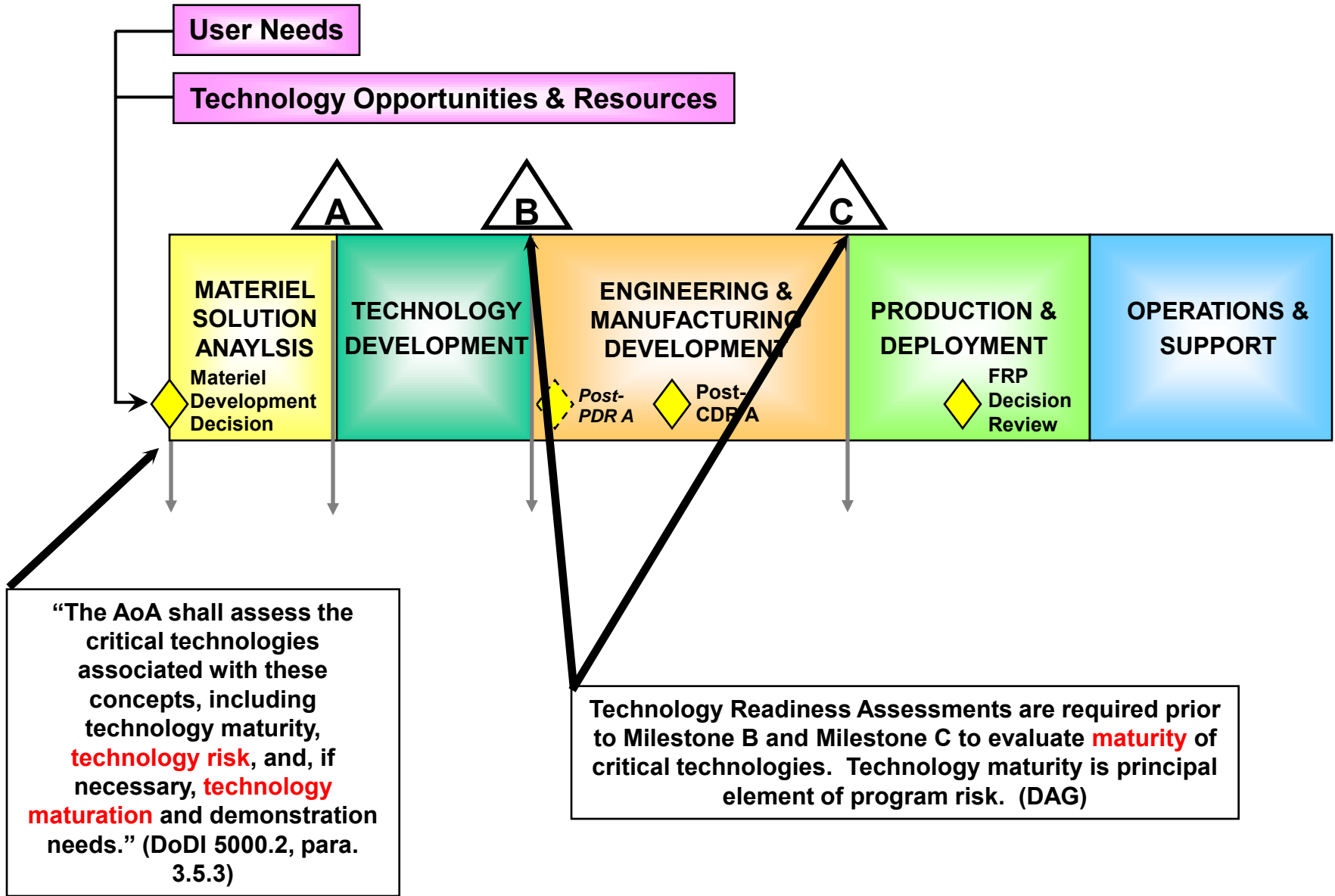
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- Materiel Development Decision precedes entry into any phase of the acquisition process
- PDR = Preliminary Design Review CDR = Critical Design Review
- FRP = Full Rate Production

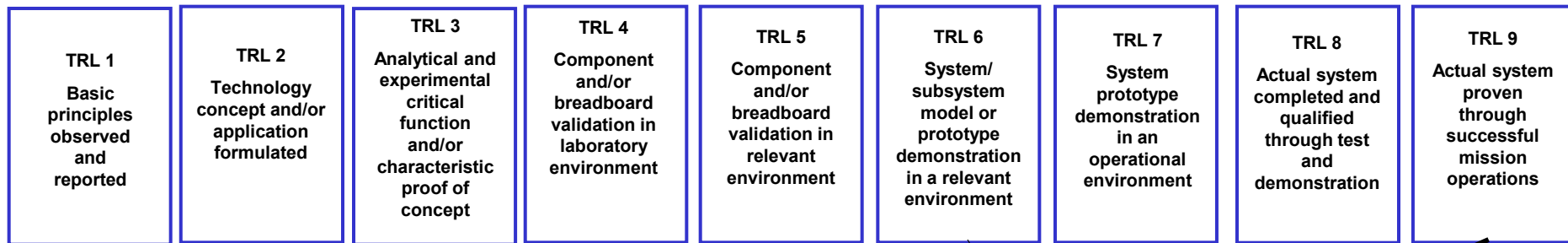
DoD Acquisition Decision Points

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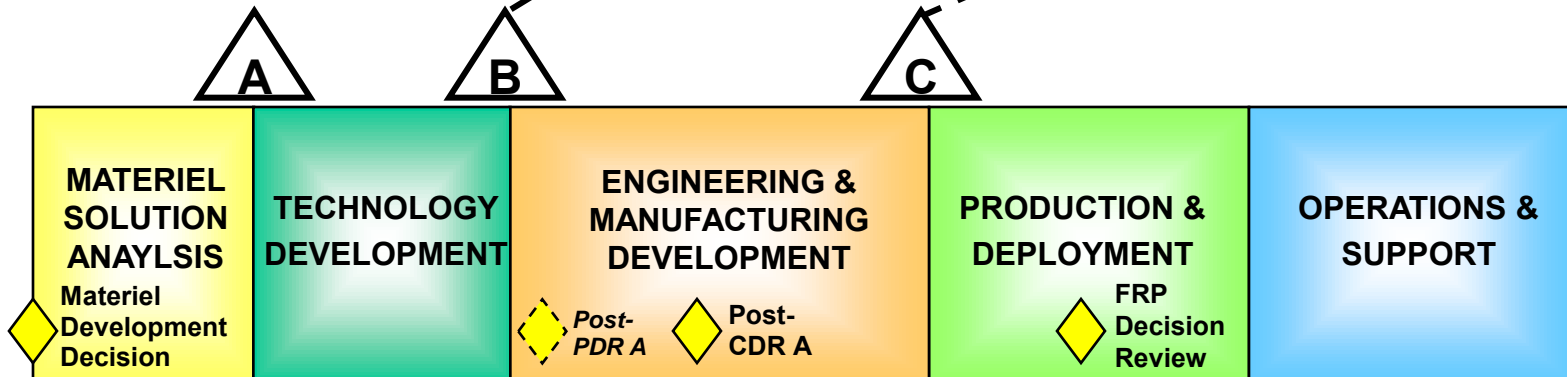
Technology Readiness Levels (TRLs)

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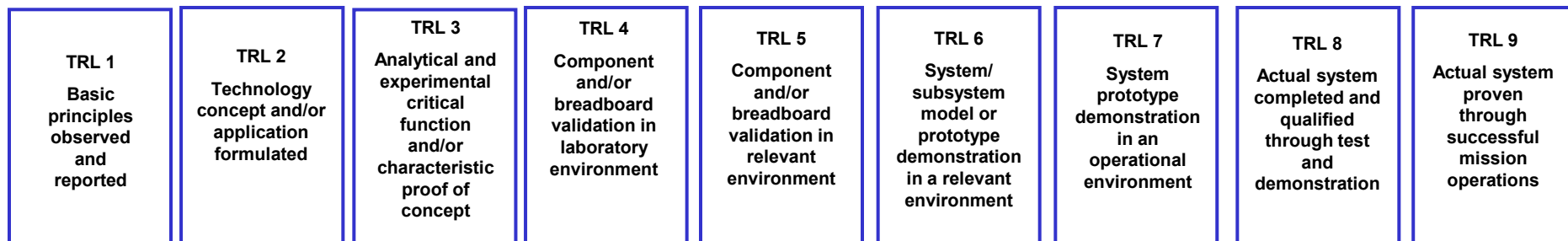
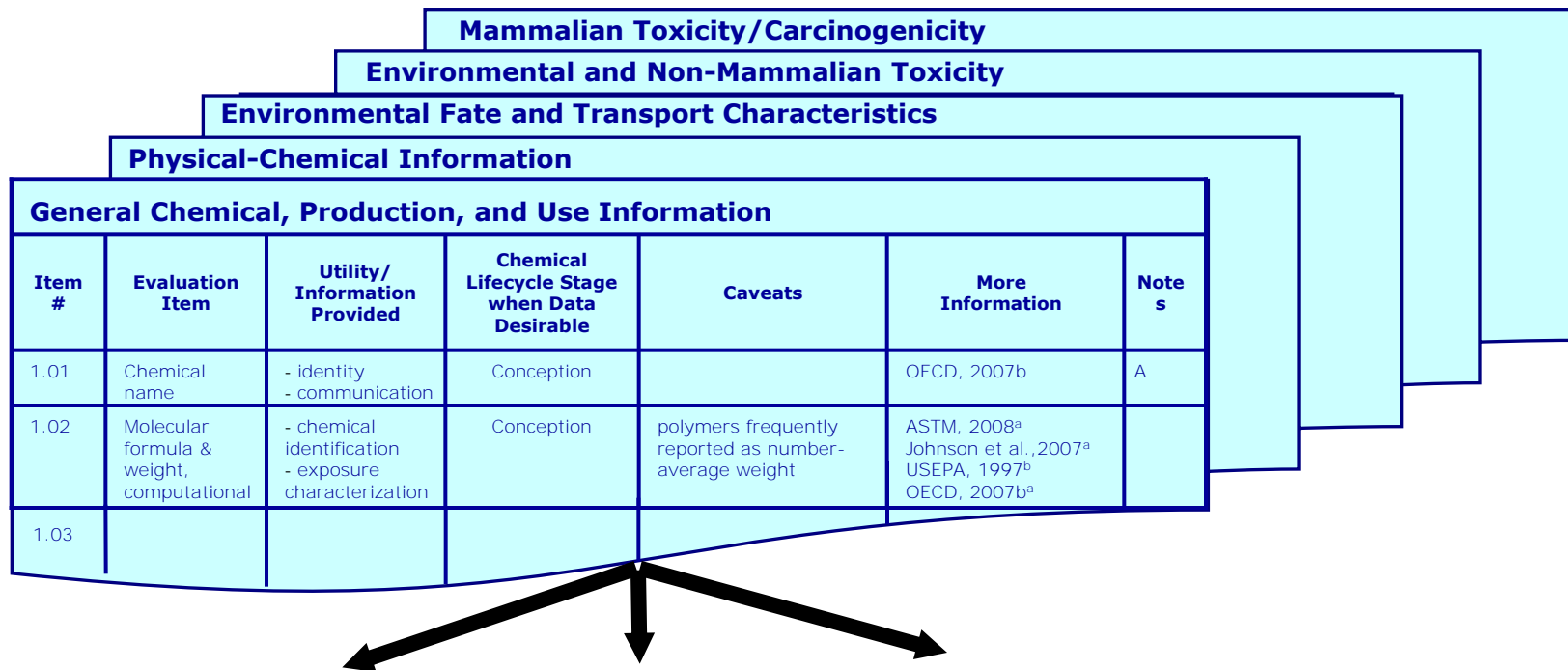
Best Practices

- MS B: \geq TRL 6
- MS C: \geq TRL 8



Tie TRLs to ESOH Data Needs

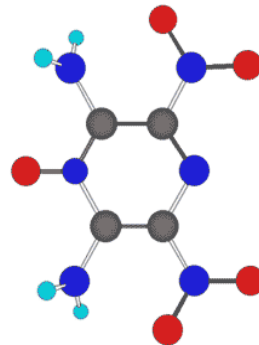
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Next Steps

- **Develop users manual for developers and program managers**
 - What information/data about a chemical/material should be in hand at various acquisition stages (or TRLs)?
 - Requirement or guidance?
- **Incorporate requirement or guidance under acquisition series policies and procedures**
- **Develop training module**
 - Defense Acquisition University
 - Self-directed learning

Questions & Discussion



Backup Slides

DoD Acquisition Hazard Evaluation Requirements

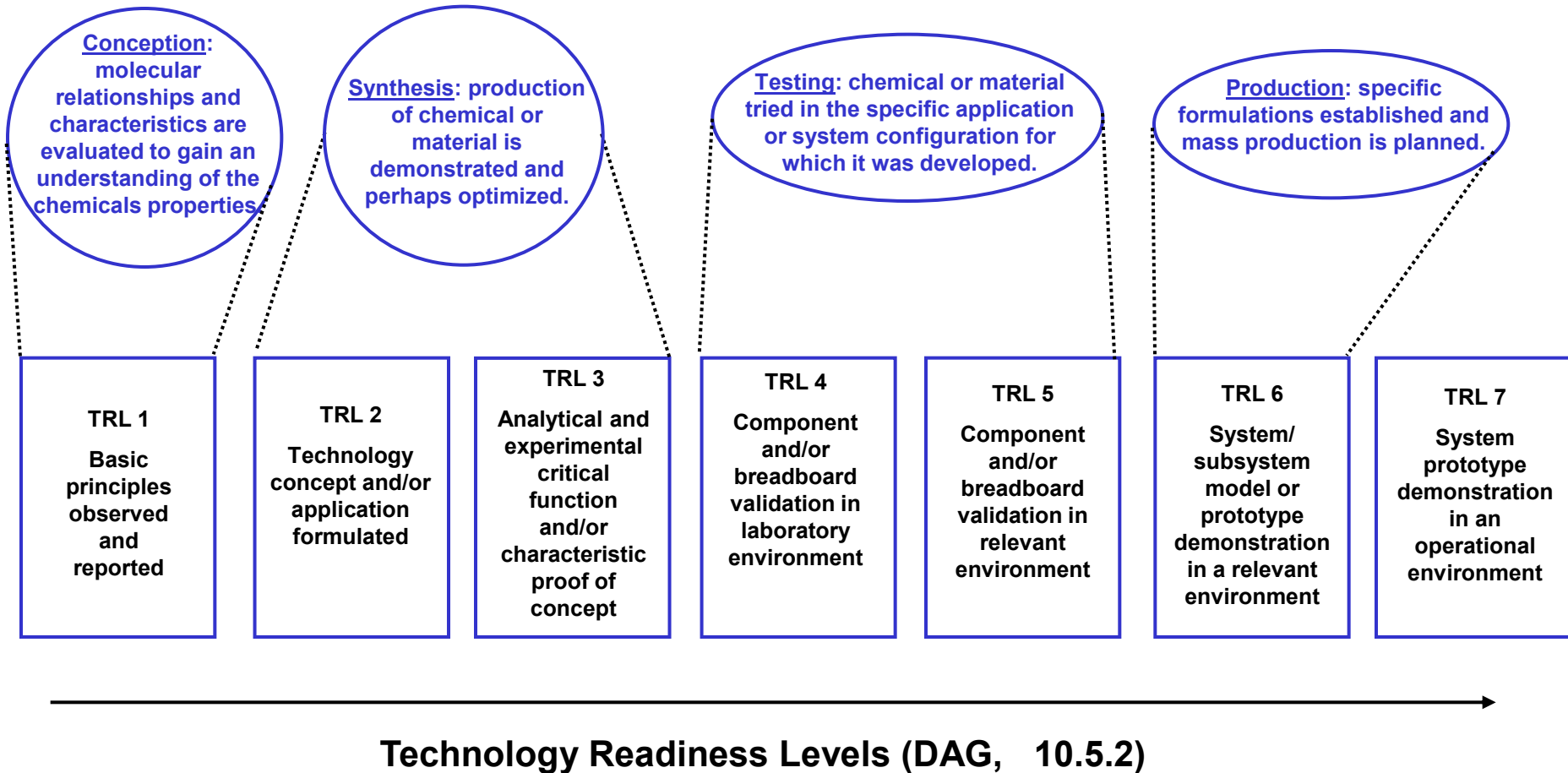
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- **MIL-STD-882D – DoD Standard Practice for System Safety**
 - Defines Hazard as “Any real or potential condition that can cause injury, illness, or death to personnel; ...; or damage to the environment.”
 - Defines Safety as “Freedom from those conditions that can cause death, injury, occupational illness, ... or damage to the environment.”

- **Defense Acquisition Guidebook (DAG): Provides minimum requirements for the PESHE**
 - Requires identification of hazardous materials used in the system and approach for incorporating hazardous material considerations into system demilitarization and disposal planning.
 - Hazardous materials risk information should include:
 - The locations and quantities of HAZMAT on the system, where applicable;
 - Energetic qualification information for each energetic material used in the system;
 - Reasonably anticipated hazardous byproducts/discharges and expected quantities of hazardous waste generated during normal use/maintenance, in addition to those anticipated in emergency situations (e.g., exhaust, fibers from composite materials released during accidents, etc.); and
 - Special HAZMAT training and handling

DoD Acquisition Hazard Evaluation Requirements

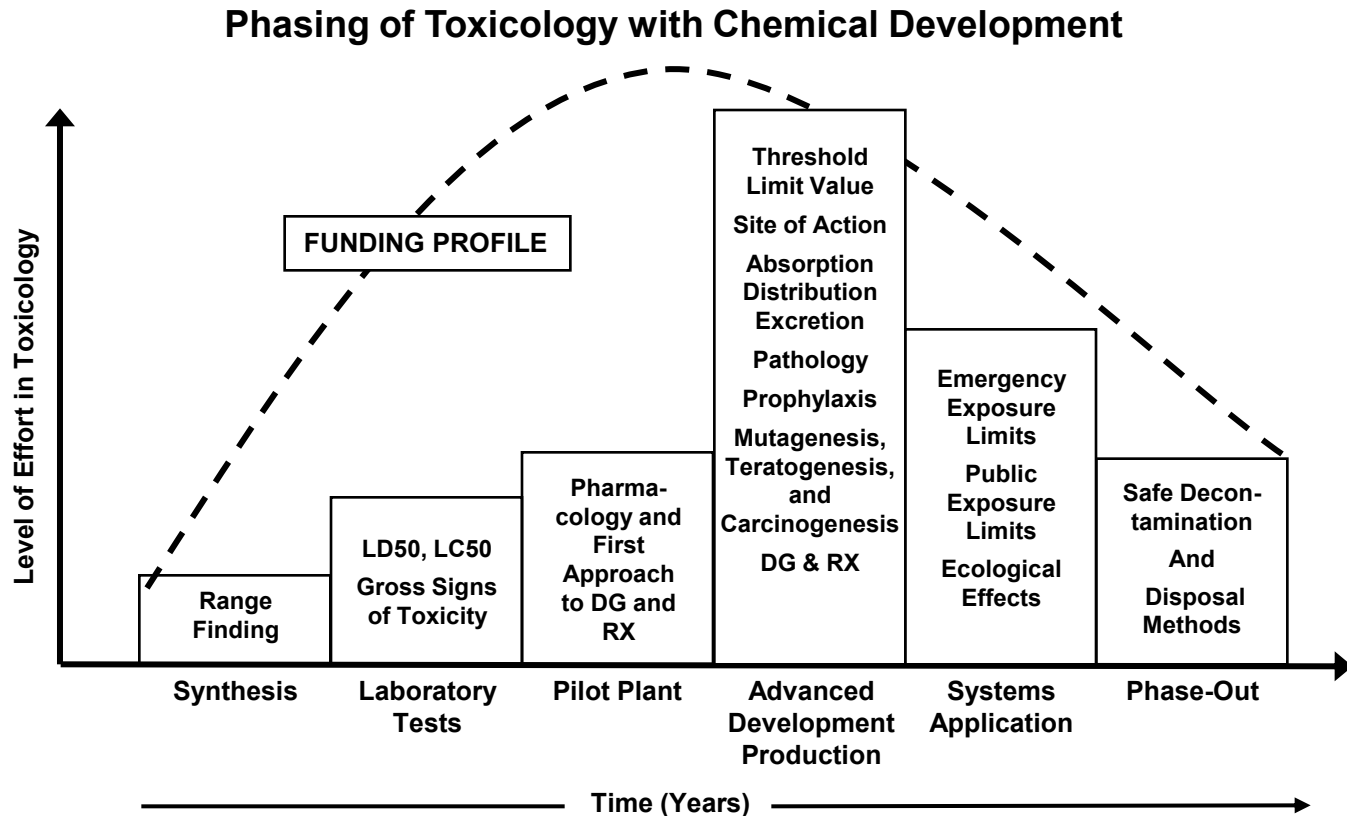
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Pioneering DoD Work

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The Impact on DoD of the Toxic Substances Control Act (AF-AMRL, 1980)*

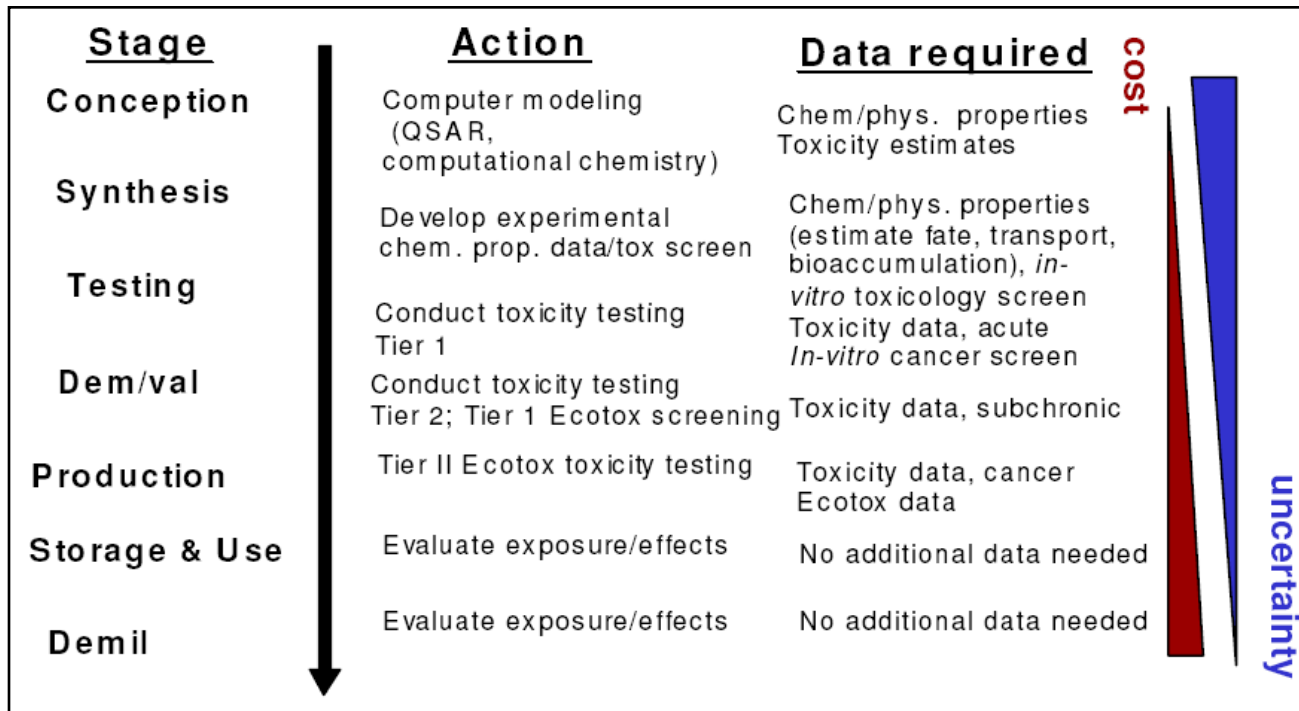


* Air Force Aerospace Medical Research Laboratory

Pioneering DoD Work

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Assessing the Potential Environmental Consequences of a New Energetic Material: A Phased Approach (USA-CHPPM 2007)



General hierarchical approach to the development of environmental data (Johnson et al., 2007)